

LAB 4

CONSTRUCT A SIMPLE NETWORK



Name: Trương Đăng Trúc Lâm

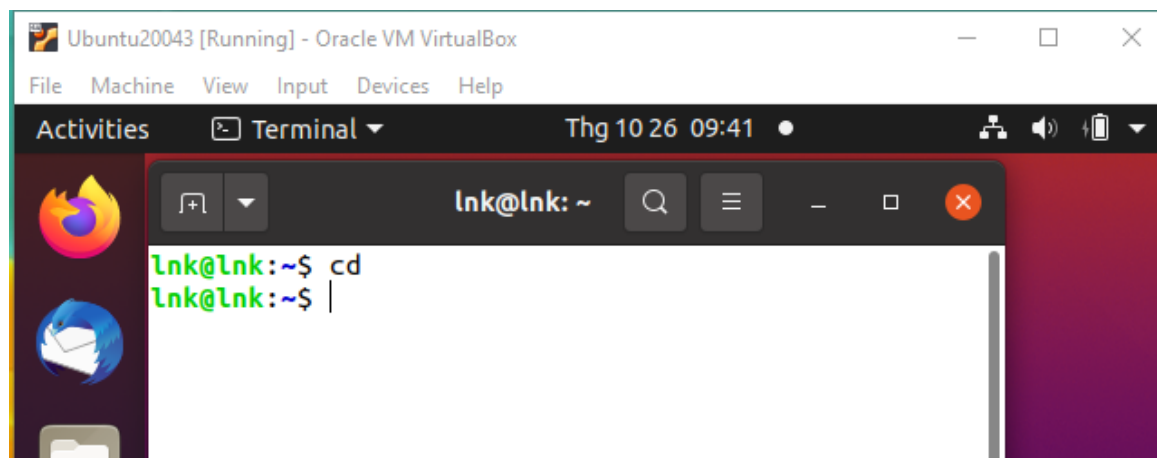
ID: B2111933

Group: M04

Submission: an [ID_NAME_Lab04.pdf](#) file describes clearly how did you solve the problem

Exercise 0: change the directory to your home directory

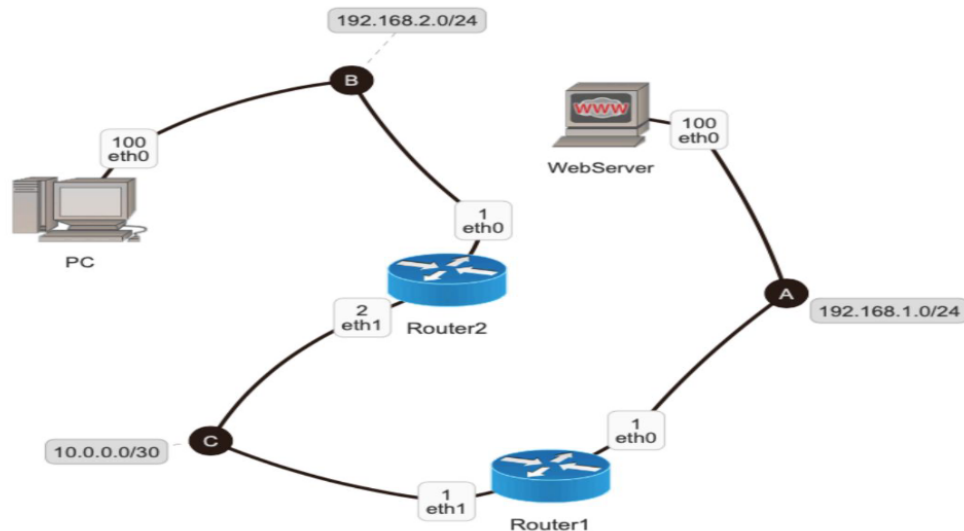
Answer: \$cd



Exercise 17

Exercise 17

Construct the following network



Create files and folders

```
student@may: ~/lab4/ex17
student@may:~/lab4/ex17$ tree
.
├── client
│   ├── client.startup
│   ├── lab.conf
│   ├── LICENSE
│   ├── router1
│   ├── router1.startup
│   ├── router2
│   ├── router2.startup
│   ├── server
│   │   ├── var
│   │   │   ├── www
│   │   │   │   ├── html
│   │   │   │   │   ├── index.html
│   ├── server.startup
│   └── shared
8 directories, 7 files
student@may:~/lab4/ex17$
```

The contents of files:

```
student@may: ~/lab4/ex17
student@may:~/lab4/ex17$ cat lab.conf
client[0]=B
router2[0]=B
router2[1]=C
router1[0]=A
router1[1]=C
server[0]=A
student@may:~/lab4/ex17$ cat client.startup
ifconfig eth0 192.168.2.100/24 up
route add default gw 192.168.2.1
student@may:~/lab4/ex17$ cat router1.startup
ifconfig eth0 192.168.1.1/24 up
ifconfig eth1 10.0.0.1/30 up
route add -net 192.168.2.0/24 gw 10.0.0.2
student@may:~/lab4/ex17$ cat router2.startup
ifconfig eth0 192.168.2.1/24 up
ifconfig eth1 10.0.0.2/30 up
route add -net 192.168.1.0/24 gw 10.0.0.1
student@may:~/lab4/ex17$ cat server.startup
ifconfig eth0 192.168.1.100/24 up
route add default gw 192.168.1.1
/etc/init.d/apache2 start
student@may:~/lab4/ex17$
```

Start the lab and test connectivity

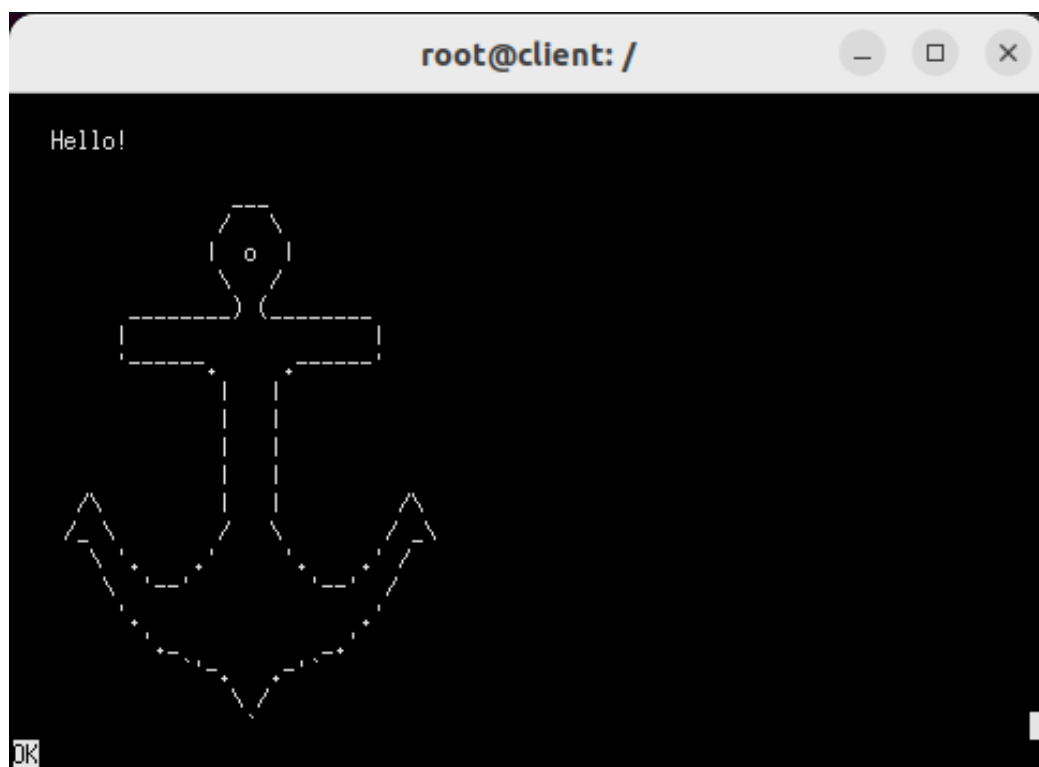
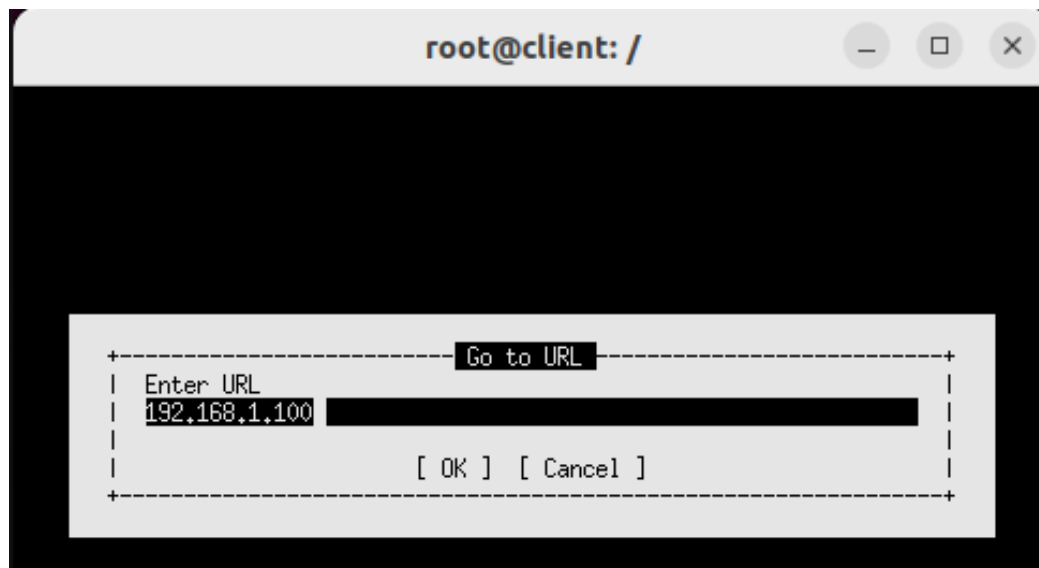
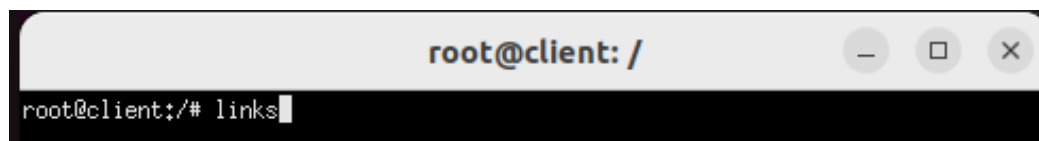
```
root@server: /
root@server:/# ping -c 3 192.168.1.100
PING 192.168.1.100 (192.168.1.100) 56(84) bytes of data:
64 bytes from 192.168.1.100: icmp_seq=1 ttl=64 time=0.067 ms
64 bytes from 192.168.1.100: icmp_seq=2 ttl=64 time=0.051 ms
64 bytes from 192.168.1.100: icmp_seq=3 ttl=64 time=0.058 ms

--- 192.168.1.100 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2034ms
rtt min/avg/max/mdev = 0.051/0.058/0.067/0.006 ms
root@server:/#
```

On server

```
root@server: /
root@server:/# /etc/init.d/apache2 start
Starting Apache httpd web server: apache2.
root@server:/# tcpdump -s 1536 -w /shared/ex17_webserver.pcap
```

On client



Back to server

```

root@server: /

root@server:~# /etc/init.d/apache2 start
Starting Apache httpd web server: apache2.
root@server:~# tcpdump -s 1536 -w /shared/ex17_webserver.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot length 1536 by
tes
^C16 packets captured
16 packets received by filter
0 packets dropped by kernel
root@server:~#

```

Open ex17_webserver.pcap to examine Frames and discover the TCP Header

ex17_webserver.pcap

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length
1	0.000000	1e:7a:aa:9e:e4:2a	Broadcast	ARP	42
2	0.000007	c6:c3:e8:21:1f:6d	1e:7a:aa:9e:e4:2a	ARP	42
3	0.000013	192.168.2.100	192.168.1.100	TCP	74

Frame 3: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)

Ethernet II, Src: 1e:7a:aa:9e:e4:2a (1e:7a:aa:9e:e4:2a), Dst: c6:c3:e8:21:1f:6d (c6:c3:e8:21:1f:6d)

Internet Protocol Version 4, Src: 192.168.2.100, Dst: 192.168.1.100

Transmission Control Protocol, Src Port: 50194, Dst Port: 80, Seq: 0, Len: 0

Source Port: 50194
Destination Port: 80
[Stream index: 0]
[Conversation completeness: Complete, WITH_DATA (31)]
[TCP Segment Len: 0]
Sequence Number: 0 (relative sequence number)
Sequence Number (raw): 2039751334
[Next Sequence Number: 1 (relative sequence number)]
Acknowledgment Number: 0
Acknowledgment number (raw): 0
1010 = Header Length: 40 bytes (10)
Flags: 0x002 (SYN)
Window: 64240
[Calculated window size: 64240]

Offset	Hex	ASCII
0000	c6 c3 e8 21 1f 6d 1e 7a aa 9e e4 2a 08 00 45 00	...!.m.z...*.E.
0010	00 3c d1 92 40 00 3e 06 e6 10 c0 a8 02 64 c0 a8	<...@.>.....d..
0020	01 64 c4 12 00 50 79 94 22 a6 00 00 00 00 a0 02	.d...Py.".....
0030	fa f0 85 47 00 00 02 04 05 b4 04 02 08 0a 82 28	...G.....(
0040	14 f2 00 00 00 00 01 03 03 07

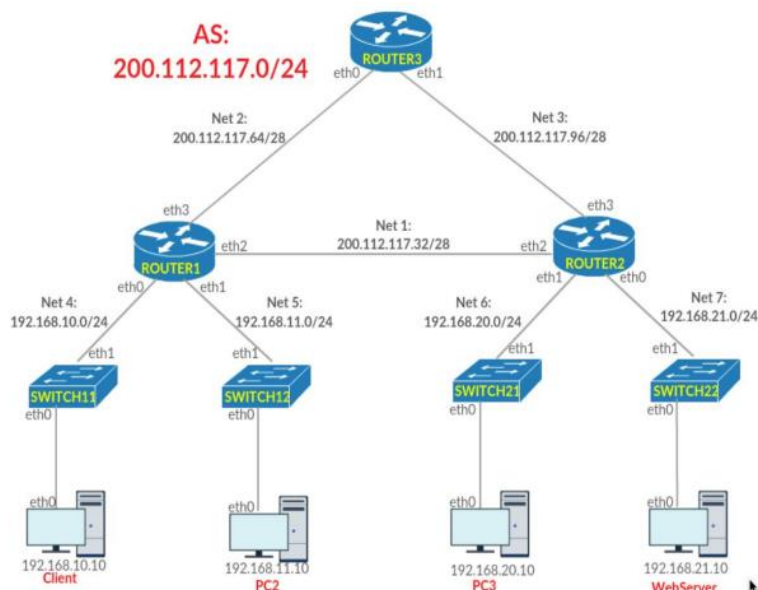
Transmission Control ...toloc (tcp), 40 byte: Packets: 16 · Displayed: 16 (100.0%) Profile: Default

Frame 3 – Length 74 bytes - Source Port: 50194 - Destination Port: 80 (HTTP)

Exercise 18

Exercise 18

Construct the following network.
All Routers use the RIPv2 protocol

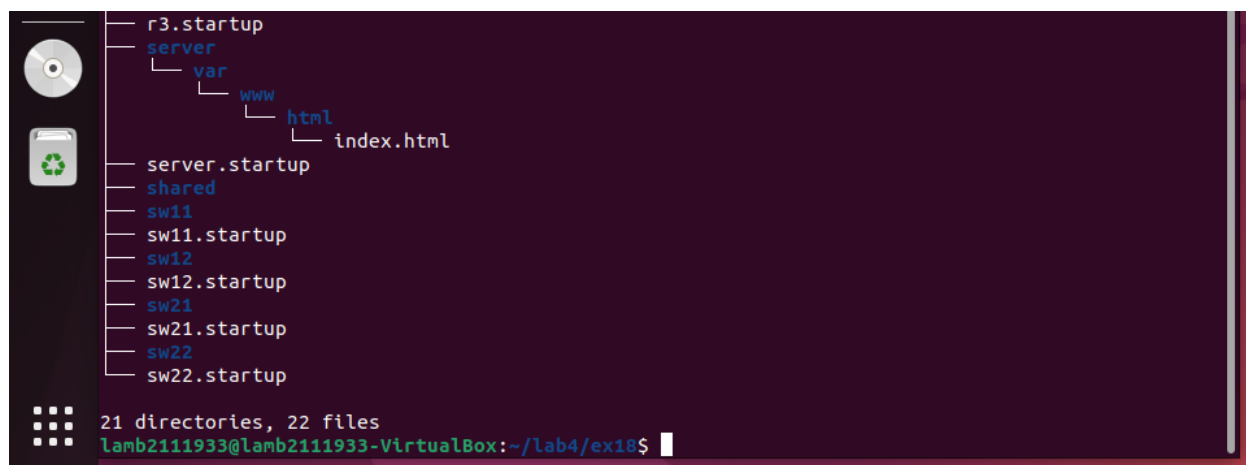


Create files and folders

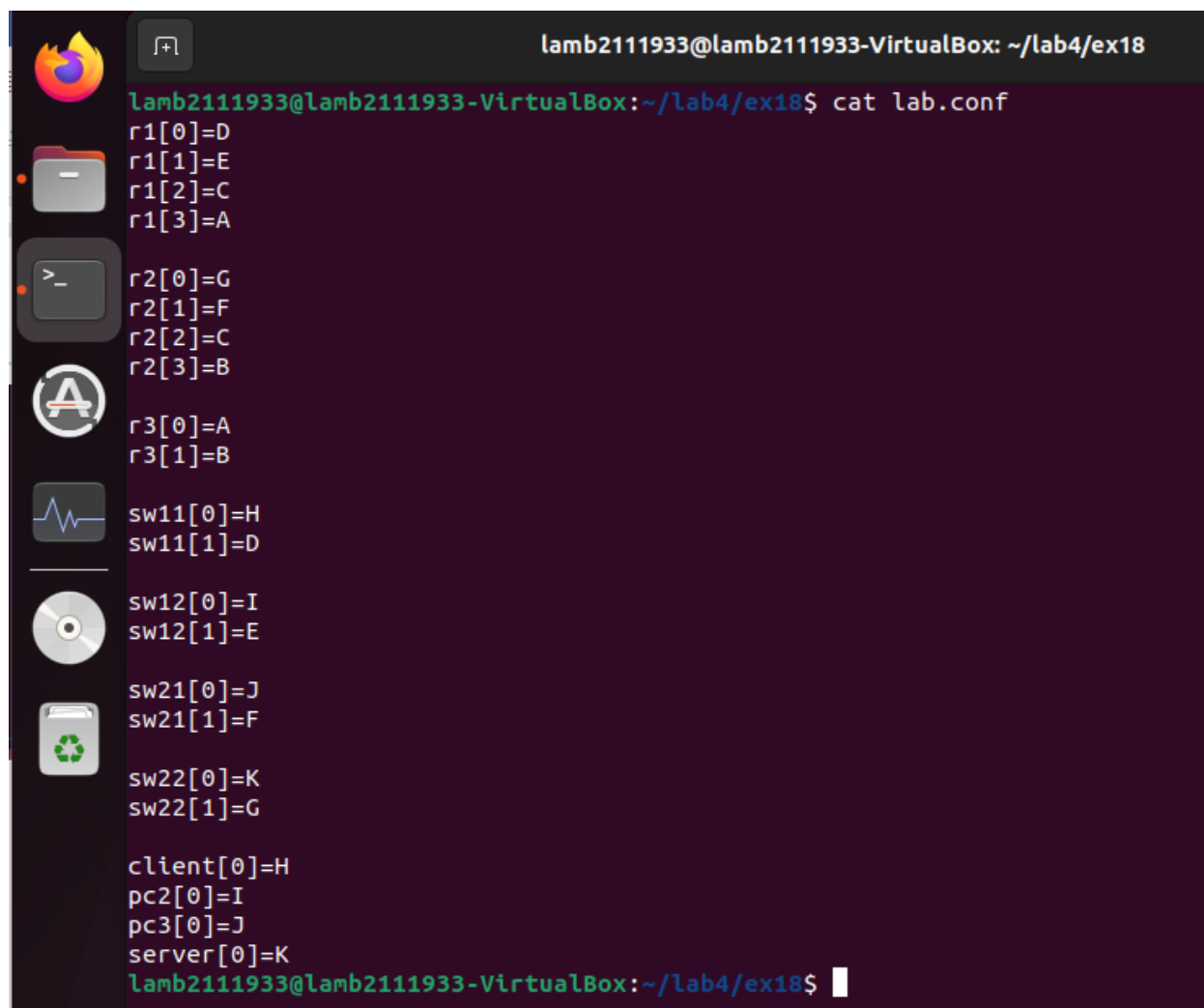
```

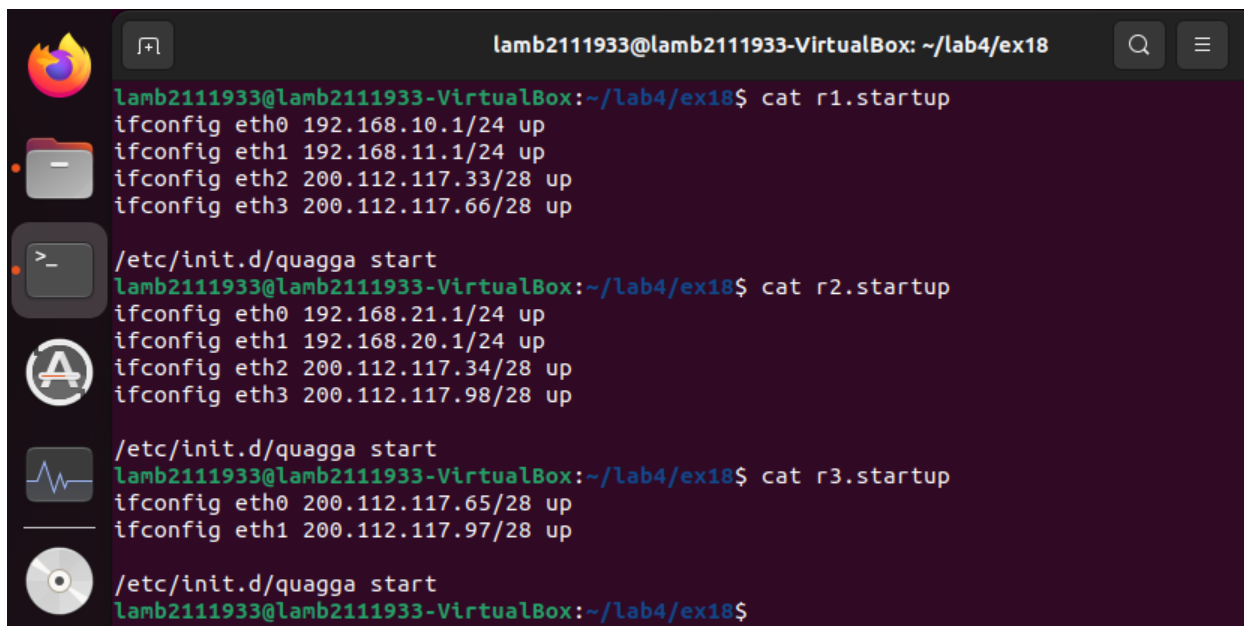
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ tree
.
├── client
│   ├── client.startup
│   └── lab.conf
├── pc2
│   ├── pc2.startup
│   └── pc2.conf
├── pc3
│   ├── pc3.startup
│   └── pc3.conf
├── r1
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       ├── ripd.conf
│   │       └── zebra.conf
│   ├── r1.startup
│   └── r1.conf
├── r2
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       ├── ripd.conf
│   │       └── zebra.conf
│   ├── r2.startup
│   └── r2.conf
├── r3
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       ├── ripd.conf
│   │       └── zebra.conf
│   ├── r3.startup
│   └── r3.conf
└── r3.conf

```



The contents of files



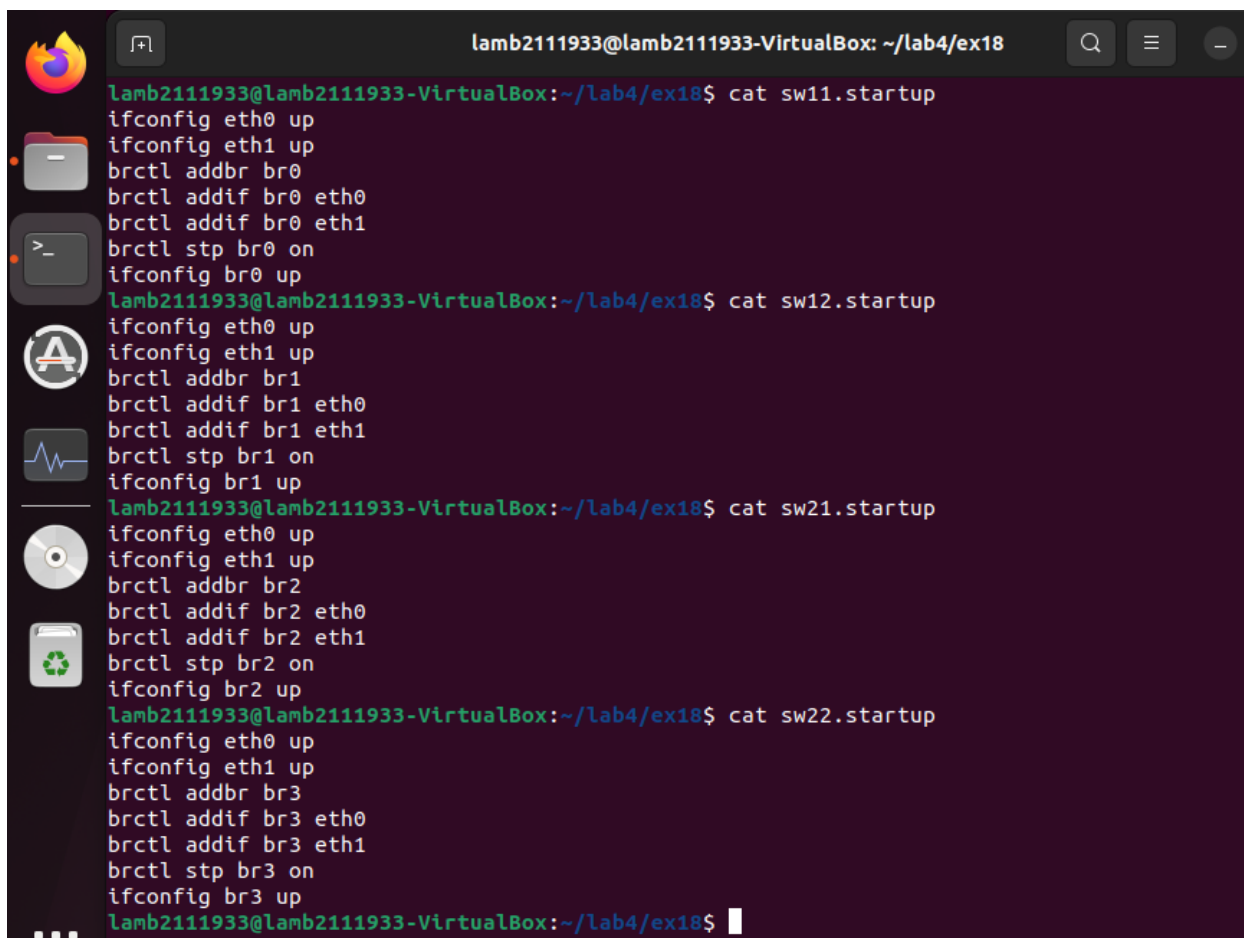


```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r1.startup
ifconfig eth0 192.168.10.1/24 up
ifconfig eth1 192.168.11.1/24 up
ifconfig eth2 200.112.117.33/28 up
ifconfig eth3 200.112.117.66/28 up

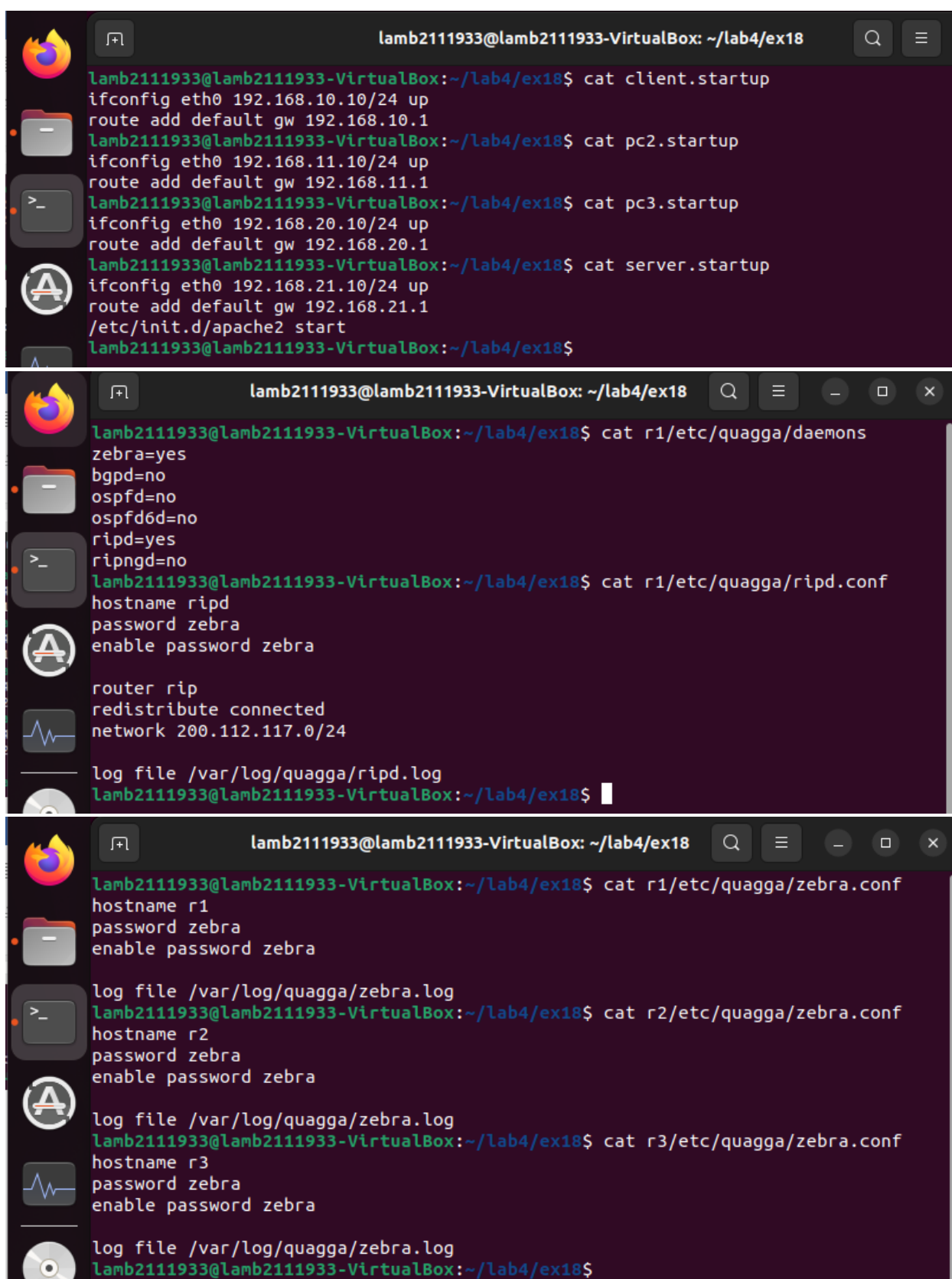
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r2.startup
ifconfig eth0 192.168.21.1/24 up
ifconfig eth1 192.168.20.1/24 up
ifconfig eth2 200.112.117.34/28 up
ifconfig eth3 200.112.117.98/28 up

/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r3.startup
ifconfig eth0 200.112.117.65/28 up
ifconfig eth1 200.112.117.97/28 up

/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$
```



```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat sw11.startup
ifconfig eth0 up
ifconfig eth1 up
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl stp br0 on
ifconfig br0 up
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat sw12.startup
ifconfig eth0 up
ifconfig eth1 up
brctl addbr br1
brctl addif br1 eth0
brctl addif br1 eth1
brctl stp br1 on
ifconfig br1 up
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat sw21.startup
ifconfig eth0 up
ifconfig eth1 up
brctl addbr br2
brctl addif br2 eth0
brctl addif br2 eth1
brctl stp br2 on
ifconfig br2 up
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat sw22.startup
ifconfig eth0 up
ifconfig eth1 up
brctl addbr br3
brctl addif br3 eth0
brctl addif br3 eth1
brctl stp br3 on
ifconfig br3 up
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$
```

The image displays three terminal windows from a virtual machine named 'lamb2111933-VirtualBox'. The user is 'lamb2111933' and the current directory is '~/lab4/ex18'. The windows show the configuration of network interfaces and Quagga daemons for three different hosts (client, pc2, pc3, server, r1, r2, r3).

```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat client.startup
ifconfig eth0 192.168.10.10/24 up
route add default gw 192.168.10.1
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat pc2.startup
ifconfig eth0 192.168.11.10/24 up
route add default gw 192.168.11.1
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat pc3.startup
ifconfig eth0 192.168.20.10/24 up
route add default gw 192.168.20.1
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat server.startup
ifconfig eth0 192.168.21.10/24 up
route add default gw 192.168.21.1
/etc/init.d/apache2 start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r1/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=no
ospfd6d=no
ripd=yes
ripngd=no
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r1/etc/quagga/ripd.conf
hostname ripd
password zebra
enable password zebra

router rip
redistribute connected
network 200.112.117.0/24

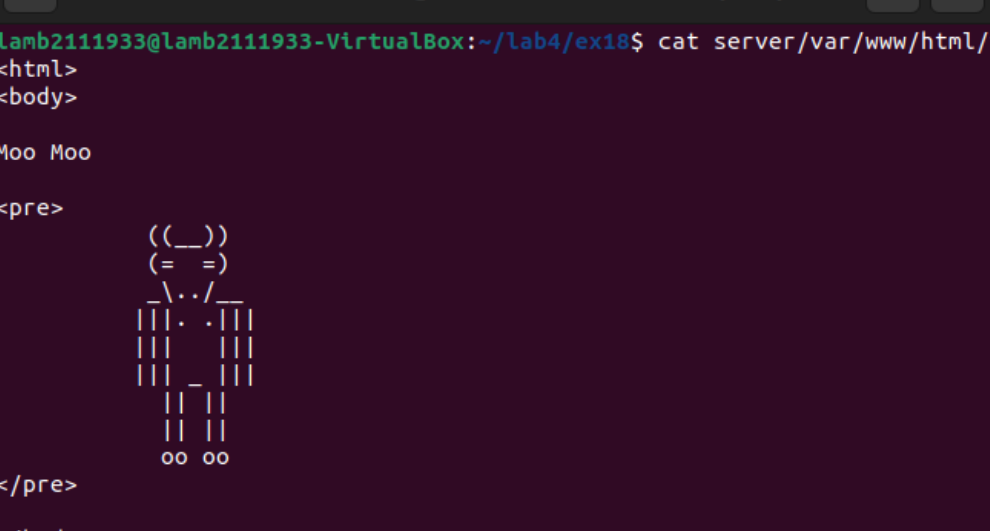
log file /var/log/quagga/ripd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r1/etc/quagga/zebra.conf
hostname r1
password zebra
enable password zebra

log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r2/etc/quagga/zebra.conf
hostname r2
password zebra
enable password zebra

log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r3/etc/quagga/zebra.conf
hostname r3
password zebra
enable password zebra

log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$
```

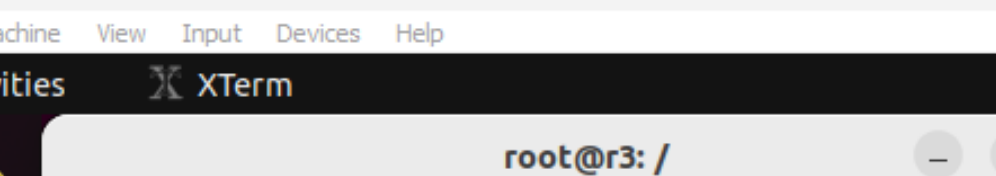


```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18$ cat server/var/www/html/index.html
<html>
<body>

Moo Moo

<pre>
      ((__))
      (=  =)
      \.. /__
      ||| . |||
      ||| . |||
      ||| _ |||
        ||  ||
        ||  ||
        oo  oo
</pre>
</body>
</html>
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18$
```

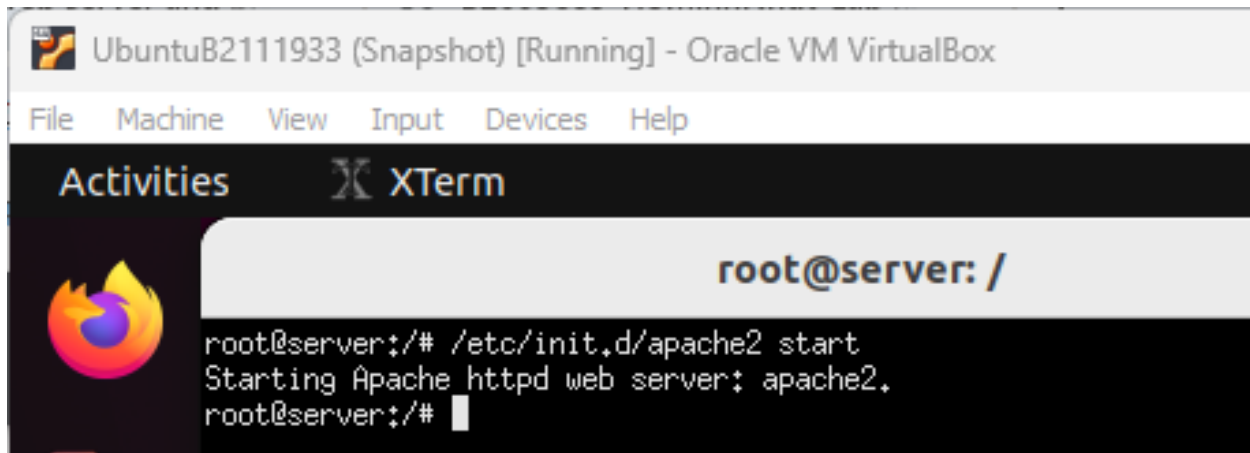
Start the lab and test connectivity



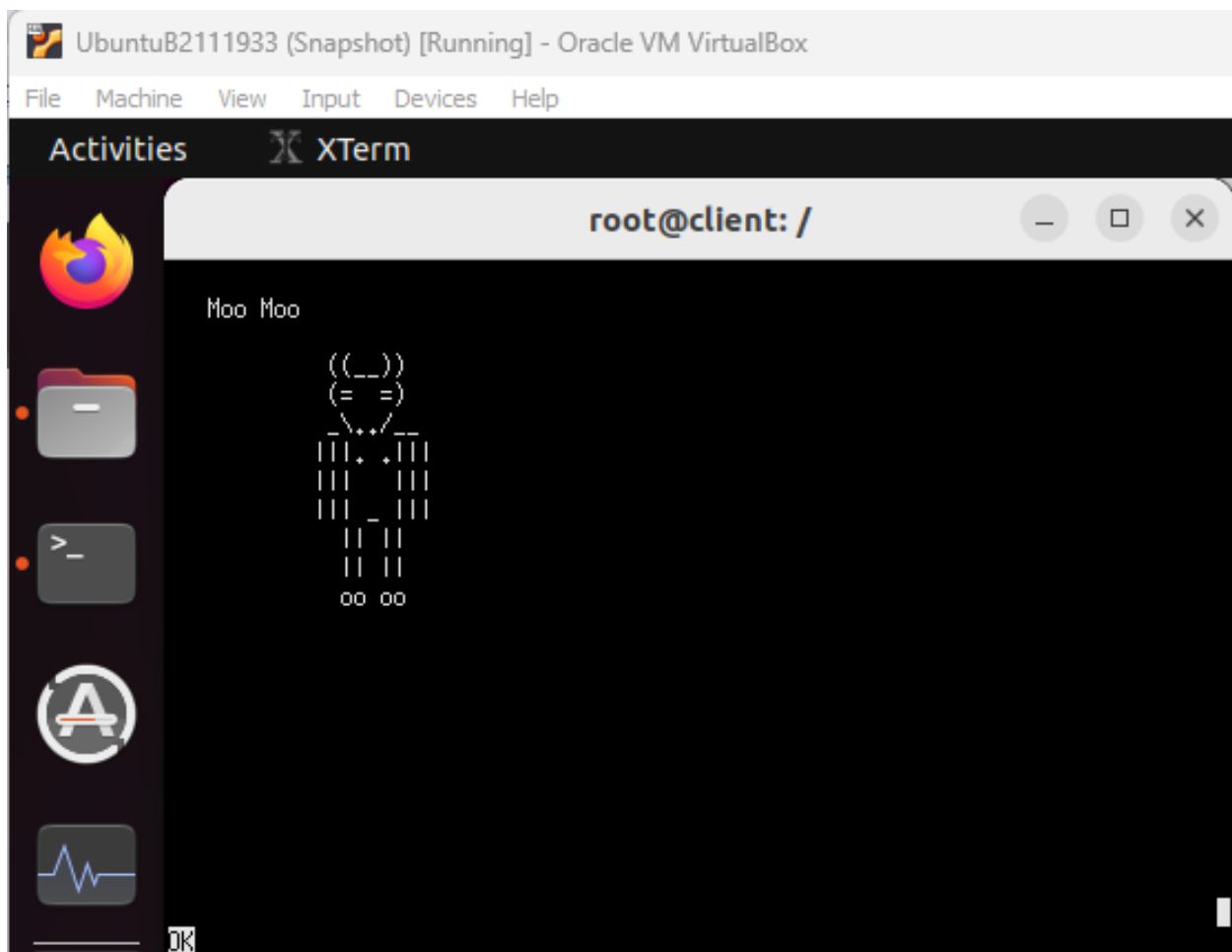
The screenshot shows a virtual machine window titled "UbuntuB2111933 (Snapshot) [Running] - Oracle VM VirtualBox". The window has a menu bar with "File", "Machine", "View", "Input", "Devices", and "Help". Below the menu bar, there is a panel with "Activities" and "XTerm". The XTerm window shows a terminal session with the prompt "root@r3: /". The user has entered the command "route -n", which displays the "Kernel IP routing table". The table has columns for Destination, Gateway, Genmask, Flags, Metric, Ref, Use, and Iface. The data rows show routes for destinations 192.168.10.0, 192.168.11.0, 192.168.20.0, 192.168.21.0, 200.112.117.32, 200.112.117.64, and 200.112.117.96, all with a gateway of 200.112.117.66 or 0.0.0.0. The flags are UG or U, and the metric is 20 or 0. The interface is eth0 or eth1.

```
root@r3: /  
root@r3:/# route -n  
Kernel IP routing table  
Destination        Gateway            Genmask           Flags  Metric  Ref    Use  Iface  
192.168.10.0        200.112.117.66    255.255.255.0    UG      20      0      0    eth0  
192.168.11.0        200.112.117.66    255.255.255.0    UG      20      0      0    eth0  
192.168.20.0        200.112.117.98    255.255.255.0    UG      20      0      0    eth1  
192.168.21.0        200.112.117.98    255.255.255.0    UG      20      0      0    eth1  
200.112.117.32      200.112.117.66    255.255.255.240  UG      20      0      0    eth0  
200.112.117.64      0.0.0.0           255.255.255.240  U       0       0      0    eth0  
200.112.117.96      0.0.0.0           255.255.255.240  U       0       0      0    eth1  
root@r3:/#
```

On server



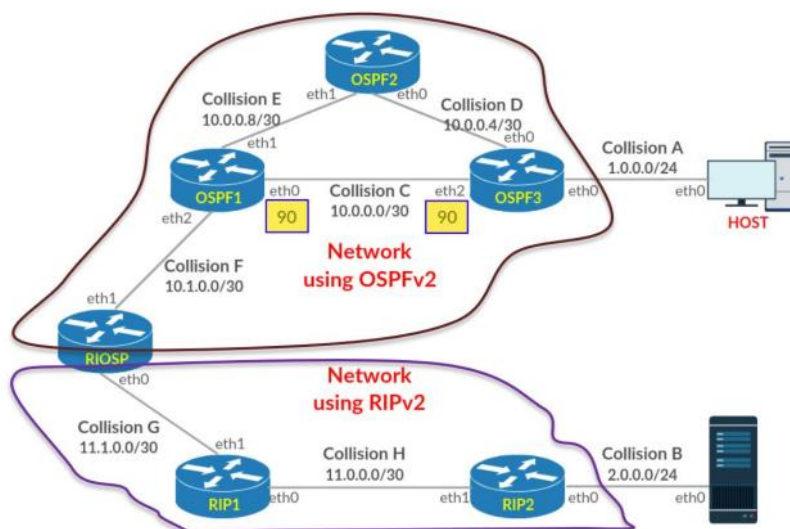
On client



Exercise 19

Exercise 19

- Construct the following network.
- Make sure the PC can view the website provided by the Server
- Change the content of the Website provided by the Server to: "HELLO, My name is Yourname, from CT106H"

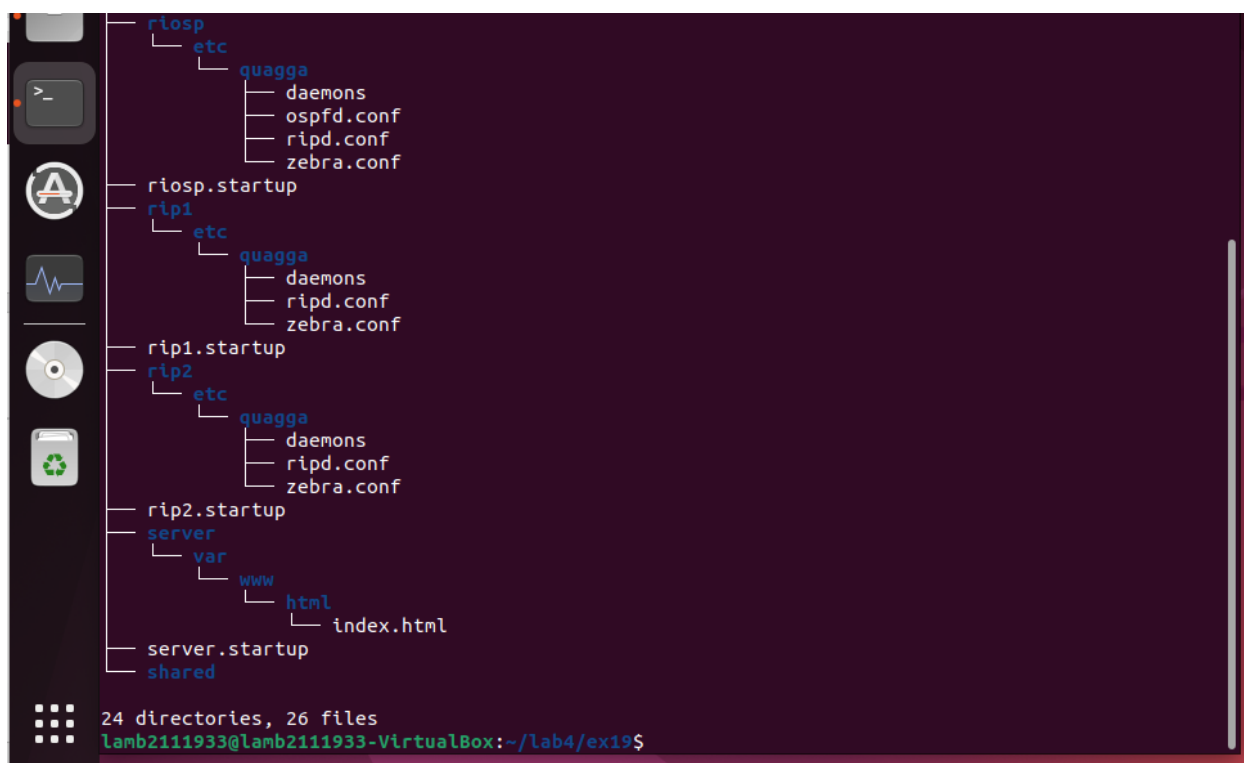


Create files and folders

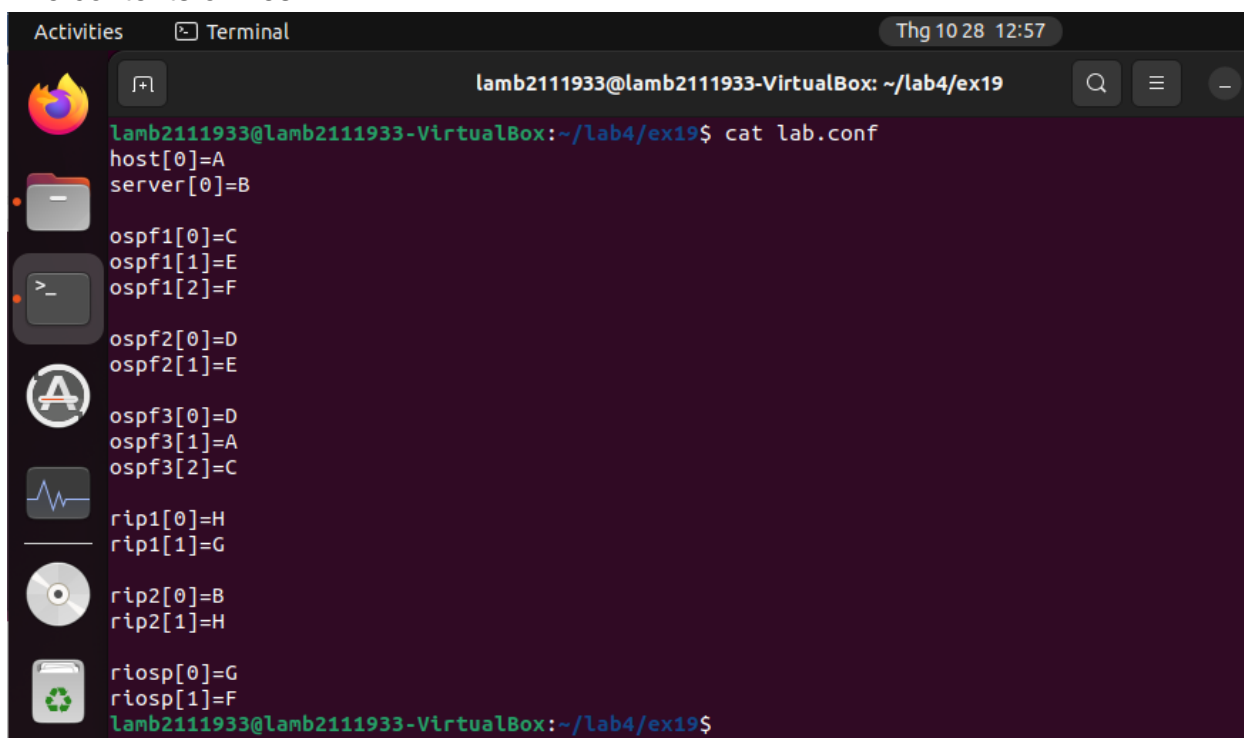
```

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex19
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ tree
.
├── host
├── host.startup
├── lab.conf
├── ospf1
│   ├── etc
│   │   ├── quagga
│   │   │   ├── daemons
│   │   │   └── ospfd.conf
│   └── ospf1.startup
├── ospf2
│   ├── etc
│   │   ├── quagga
│   │   │   ├── daemons
│   │   │   └── ospfd.conf
│   └── ospf2.startup
├── ospf3
│   ├── etc
│   │   ├── quagga
│   │   │   ├── daemons
│   │   │   └── ospfd.conf
│   └── ospf3.startup
├── riosp
│   ├── etc
│   │   ├── quagga
│   │   │   ├── daemons
│   │   │   ├── ospfd.conf
│   │   │   ├── ripd.conf
│   │   │   └── zebra.conf
└── riosp.startup

```



The contents of files



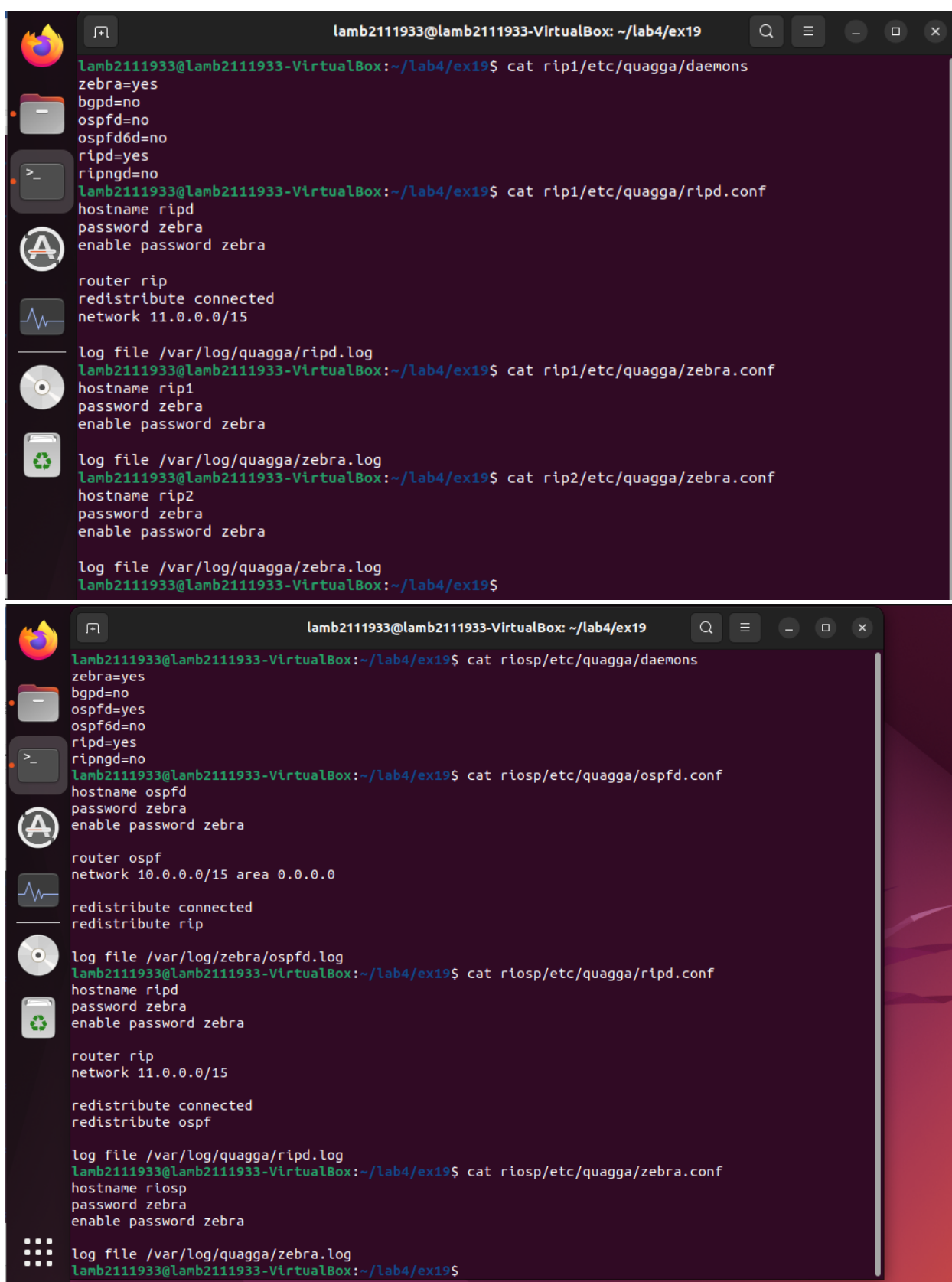
```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex19
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat host.startup
ifconfig eth0 1.0.0.2/24 up
route add default gw 1.0.0.1
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat server.startup
ifconfig eth0 2.0.0.10/24 up
route add default gw 2.0.0.1
/etc/init.d/apache2 start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat ospf1.startup
ifconfig eth0 10.0.0.1/30 up
ifconfig eth1 10.0.0.9/30 up
ifconfig eth2 10.1.0.2/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat ospf2.startup
ifconfig eth0 10.0.0.6/30 up
ifconfig eth1 10.0.0.10/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat ospf3.startup
ifconfig eth0 10.0.0.5/30 up
ifconfig eth1 1.0.0.1/24 up
ifconfig eth2 10.0.0.2/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat riosp.startup
ifconfig eth0 11.1.0.2/30 up
ifconfig eth1 10.1.0.1/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip1.startup
ifconfig eth0 11.0.0.1/30 up
ifconfig eth1 11.1.0.1/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip2.startup
ifconfig eth0 2.0.0.1/24 up
ifconfig eth1 11.0.0.2/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$
```

```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex19
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat ospf1/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=yes
ospf6d=no
ripd=no
ripngd=no
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat ospf1/etc/quagga/ospfd.conf
hostname ospfd
password zebra
enable password zebra

interface eth0
ospf cost 90
router ospf

network 10.0.0.0/15 area 0.0.0.0
redistribute connected

log file /var/log/zebra/ospfd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$
```



```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex19
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip1/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=no
ospfd6d=no
ripd=yes
ripngd=no
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip1/etc/quagga/ripd.conf
hostname ripd
password zebra
enable password zebra

router rip
redistribute connected
network 11.0.0.0/15

log file /var/log/quagga/ripd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip1/etc/quagga/zebra.conf
hostname rip1
password zebra
enable password zebra

log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip2/etc/quagga/zebra.conf
hostname rip2
password zebra
enable password zebra

log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex19
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat riosp/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=yes
ospfd6d=no
ripd=yes
ripngd=no
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat riosp/etc/quagga/ospfd.conf
hostname ospfd
password zebra
enable password zebra

router ospf
network 10.0.0.0/15 area 0.0.0.0

redistribute connected
redistribute rip

log file /var/log/zebra/ospfd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat riosp/etc/quagga/ripd.conf
hostname ripd
password zebra
enable password zebra

router rip
network 11.0.0.0/15

redistribute connected
redistribute ospf

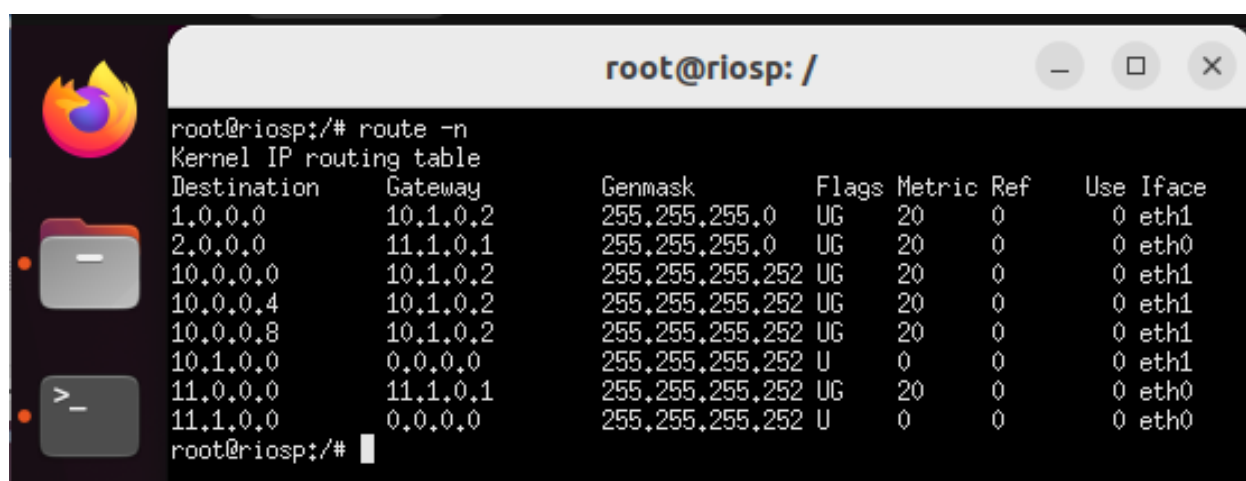
log file /var/log/quagga/ripd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat riosp/etc/quagga/zebra.conf
hostname riosp
password zebra
enable password zebra

log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$
```



A terminal window titled "lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex19". The user enters the command `cat server/var/www/html/index.html`. The output shows the content of the file: `<html>`, `<body>`, `HELLO, My name is Truong Dang Truc Lam, from CT106H`, `</body>`, and `</html>`. The prompt returns to `lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex19$`.

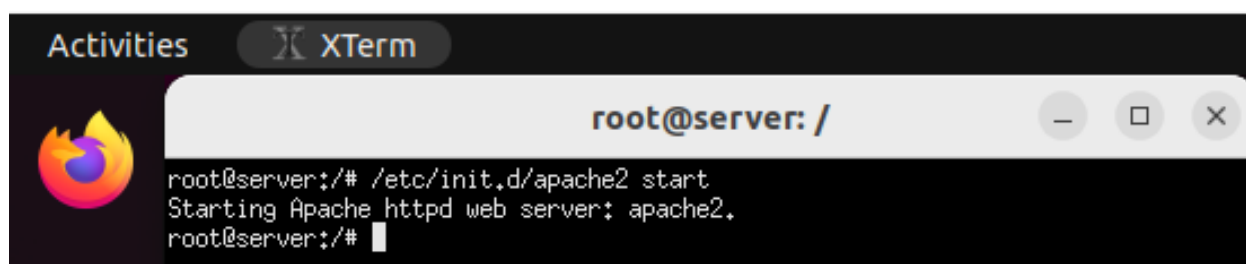
Let's check the result



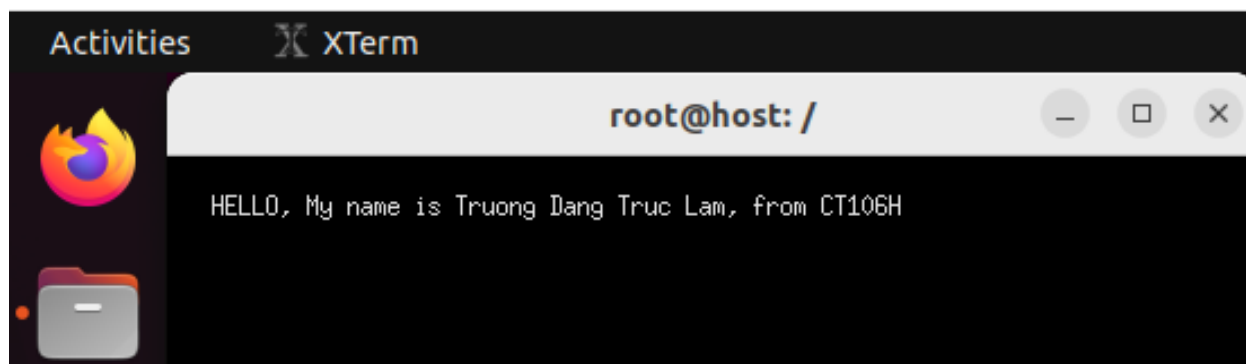
A terminal window titled "root@riosp: /". The user enters the command `route -n`. The output displays the Kernel IP routing table with columns: Destination, Gateway, Genmask, Flags, Metric, Ref, Use, and Iface. The table contains 10 entries.

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
1.0.0.0	10.1.0.2	255.255.255.0	UG	20	0	0	eth1
2.0.0.0	11.1.0.1	255.255.255.0	UG	20	0	0	eth0
10.0.0.0	10.1.0.2	255.255.255.252	UG	20	0	0	eth1
10.0.0.4	10.1.0.2	255.255.255.252	UG	20	0	0	eth1
10.0.0.8	10.1.0.2	255.255.255.252	UG	20	0	0	eth1
10.1.0.0	0.0.0.0	255.255.255.252	U	0	0	0	eth1
11.0.0.0	11.1.0.1	255.255.255.252	UG	20	0	0	eth0
11.1.0.0	0.0.0.0	255.255.255.252	U	0	0	0	eth0

The prompt returns to `root@riosp:/#`.



A terminal window titled "root@server: /". The user enters the command `/etc/init.d/apache2 start`. The output shows: `Starting Apache httpd web server: apache2.`. The prompt returns to `root@server:/#`.



A terminal window titled "root@host: /". The output shows the text: `HELLO, My name is Truong Dang Truc Lam, from CT106H`.

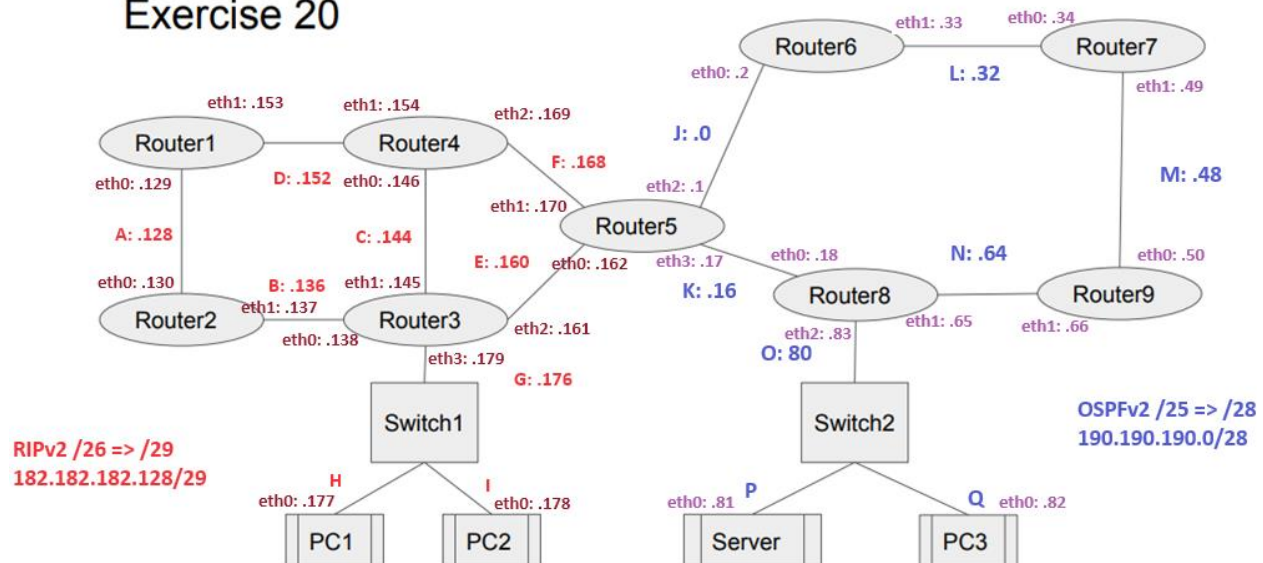
Exercise 20

Exercise 20

Construct the network on the next slide such that:

- Router 1, 2, 3, 4, 5 use the RIPv2 protocol.
 - The original network address is 182.182.182.128/26. What are the netmask and broadcast addresses of this original network?
 - Assign the network address to each LAN on the network by subnetting the original network. What are the netmask and broadcast addresses of each subnetwork?
- Router 5, 6, 7, 8, 9 use the OSPFv2 protocol.
 - The original network address is 190.190.190.0/25. What are the netmask and broadcast addresses of this original network?
 - Assign the network address to each LAN on the network by subnetting the original network. What are the netmask and broadcast addresses of each subnetwork?
- The Server provides a web service which shows “CT106H is easy!”

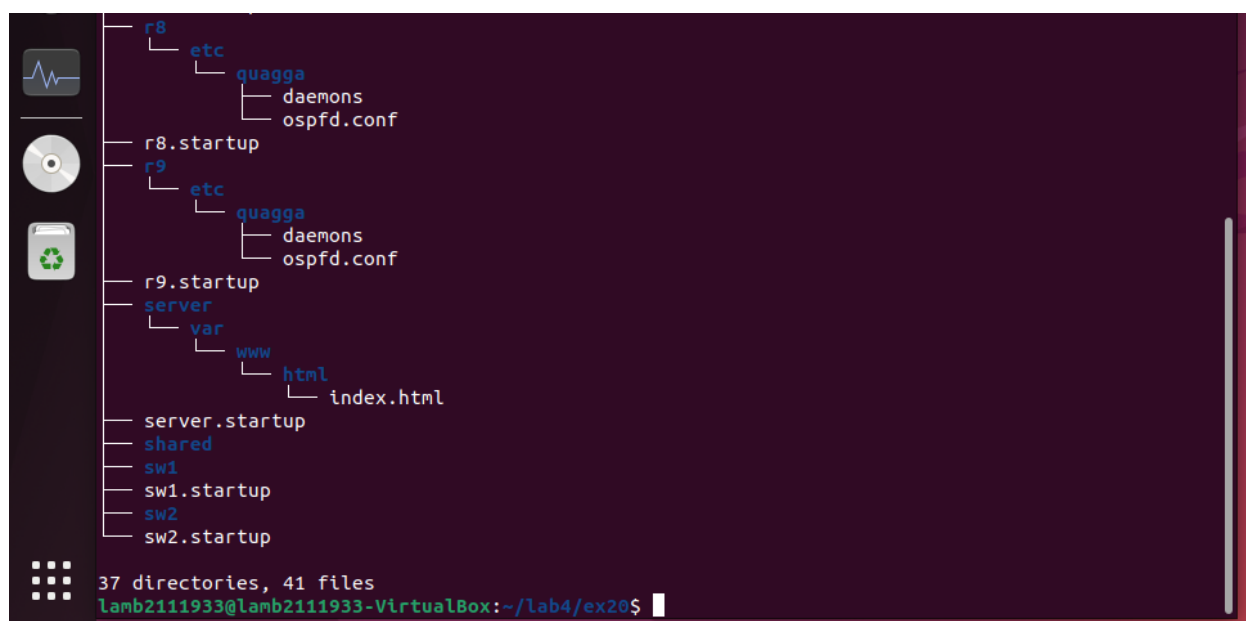
Exercise 20



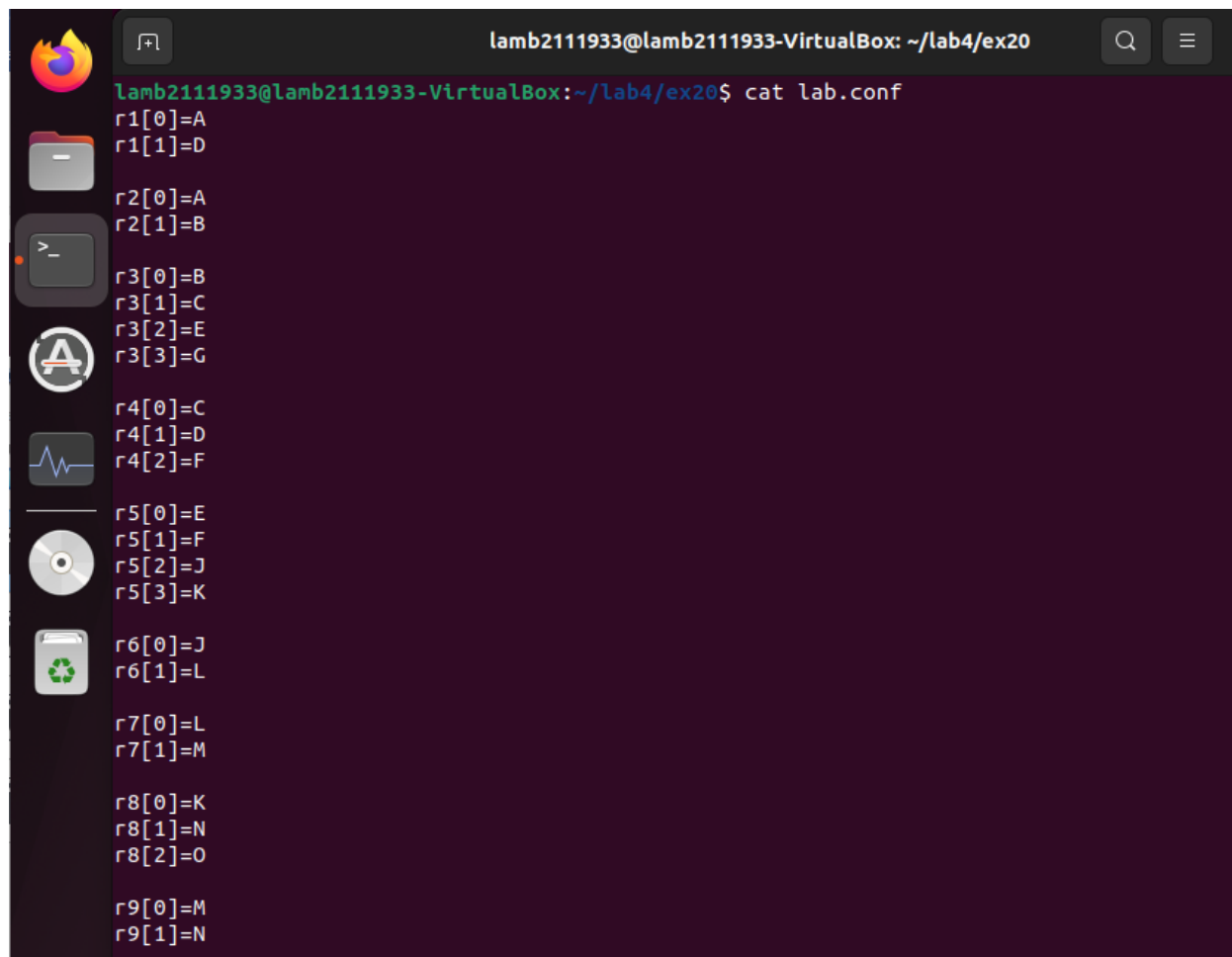
Create files and folders

```
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── r1
│   └── etc
│       └── quagga
│           ├── daemons
│           ├── ripd.conf
│           └── zebra.conf
├── r1.startup
├── r2
│   └── etc
│       └── quagga
│           ├── daemons
│           ├── ripd.conf
│           └── zebra.conf
├── r2.startup
├── r3
│   └── etc
│       └── quagga
│           ├── daemons
│           ├── ripd.conf
│           └── zebra.conf
└── r3.startup
```

```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20
├── r3.startup
├── r4
│   └── etc
│       └── quagga
│           ├── daemons
│           ├── ripd.conf
│           └── zebra.conf
├── r4.startup
├── r5
│   └── etc
│       └── quagga
│           ├── daemons
│           ├── ospfd.conf
│           ├── ripd.conf
│           └── zebra.conf
├── r5.startup
├── r6
│   └── etc
│       └── quagga
│           ├── daemons
│           └── ospfd.conf
├── r6.startup
├── r7
│   └── etc
│       └── quagga
│           ├── daemons
│           └── ospfd.conf
├── r7.startup
└── r8
```



The contents of files



```

r9[0]=M
r9[1]=N

sw1[0]=G
sw1[1]=H
sw1[2]=I

sw2[0]=O
sw2[1]=P
sw2[2]=Q

pc1[0]=H
pc2[0]=I
pc3[0]=Q

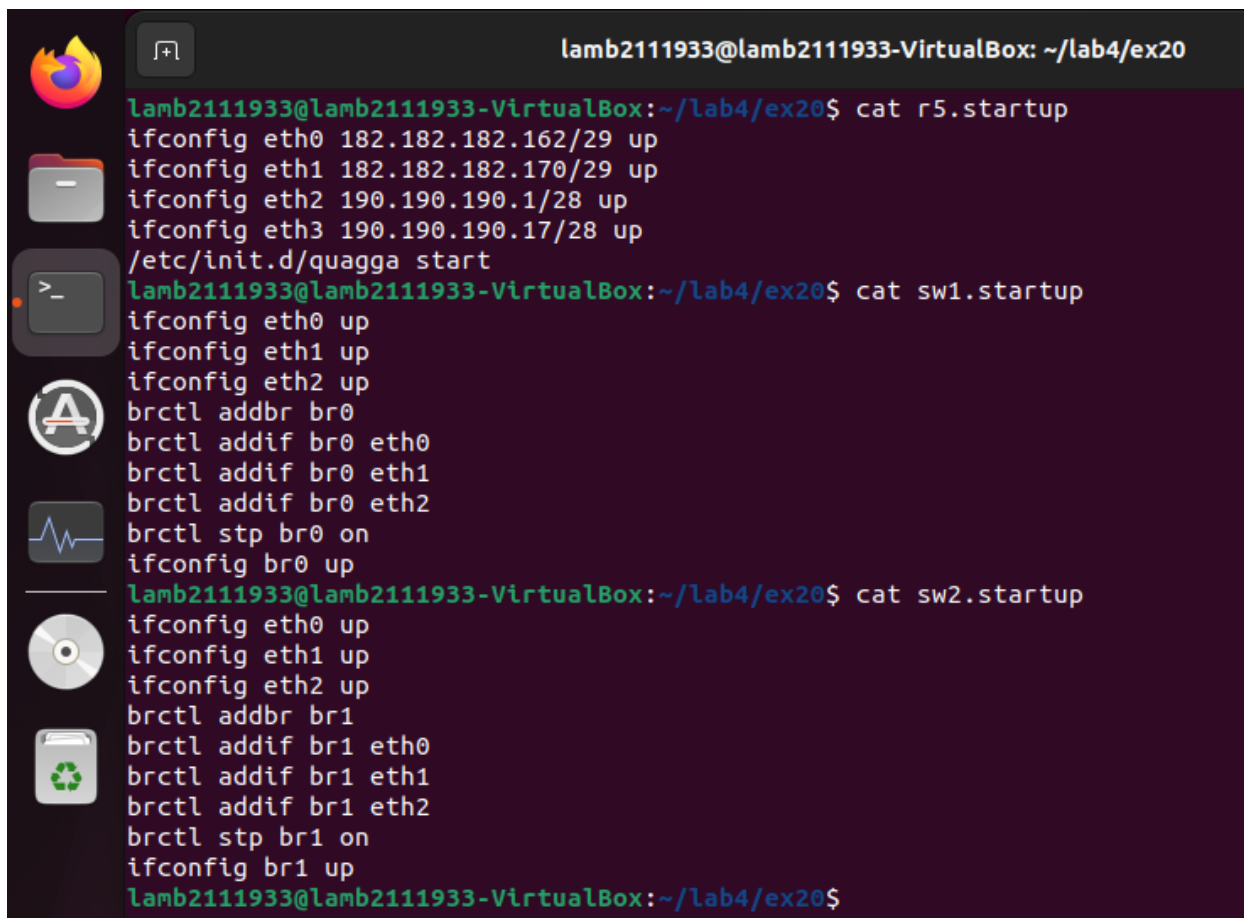
server[0]=P
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$
```

```

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$ cat r1.startup
ifconfig eth0 182.182.182.129/29 up
ifconfig eth1 182.182.182.153/29 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$ cat r2.startup
ifconfig eth0 182.182.182.130/29 up
ifconfig eth1 182.182.182.137/29 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$ cat r3.startup
ifconfig eth0 182.182.182.138/29 up
ifconfig eth1 182.182.182.145/29 up
ifconfig eth2 182.182.182.161/29 up
ifconfig eth3 182.182.182.179/29 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$ cat r4.startup
ifconfig eth0 182.182.182.146/29 up
ifconfig eth1 182.182.182.154/29 up
ifconfig eth2 182.182.182.169/29 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$
```

```

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$ cat r6.startup
ifconfig eth0 190.190.190.2/28 up
ifconfig eth1 190.190.190.33/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$ cat r7.startup
ifconfig eth0 190.190.190.34/28 up
ifconfig eth1 190.190.190.49/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$ cat r8.startup
ifconfig eth0 190.190.190.18/28 up
ifconfig eth1 190.190.190.65/28 up
ifconfig eth2 190.190.190.83/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$ cat r9.startup
ifconfig eth0 190.190.190.50/28 up
ifconfig eth1 190.190.190.66/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$
```



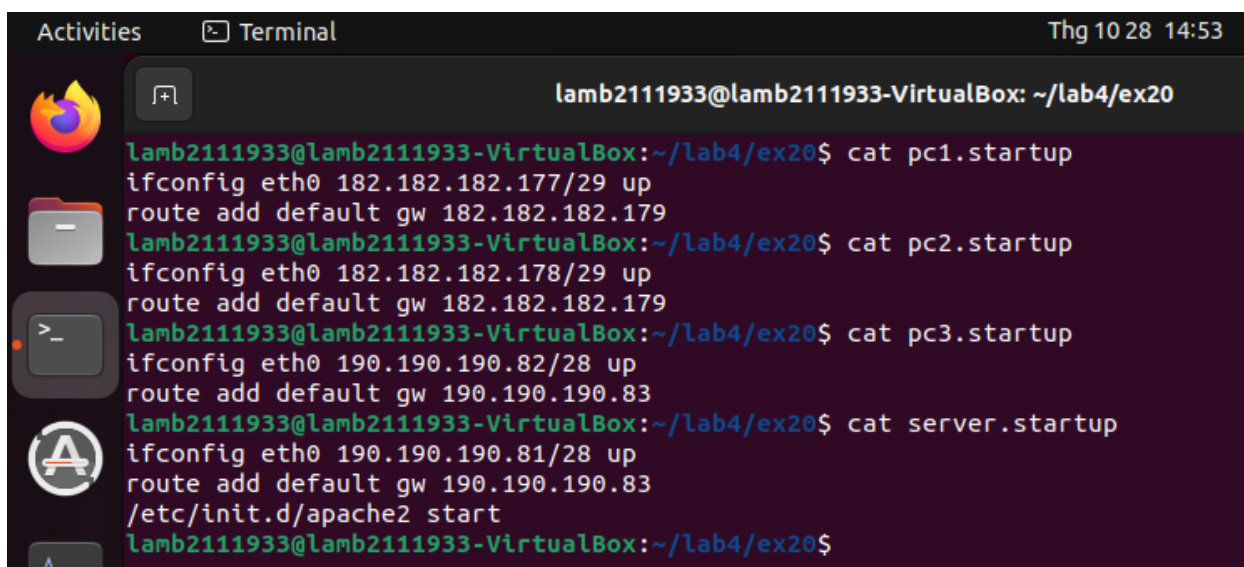
```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20

lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r5.startup
ifconfig eth0 182.182.182.162/29 up
ifconfig eth1 182.182.182.170/29 up
ifconfig eth2 190.190.190.1/28 up
ifconfig eth3 190.190.190.17/28 up
/etc/init.d/quagga start

lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat sw1.startup
ifconfig eth0 up
ifconfig eth1 up
ifconfig eth2 up
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl stp br0 on
ifconfig br0 up

lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat sw2.startup
ifconfig eth0 up
ifconfig eth1 up
ifconfig eth2 up
brctl addbr br1
brctl addif br1 eth0
brctl addif br1 eth1
brctl addif br1 eth2
brctl stp br1 on
ifconfig br1 up

lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$
```



```
Activities  Terminal  Thg 10 28 14:53

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20

lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat pc1.startup
ifconfig eth0 182.182.182.177/29 up
route add default gw 182.182.182.179

lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat pc2.startup
ifconfig eth0 182.182.182.178/29 up
route add default gw 182.182.182.179

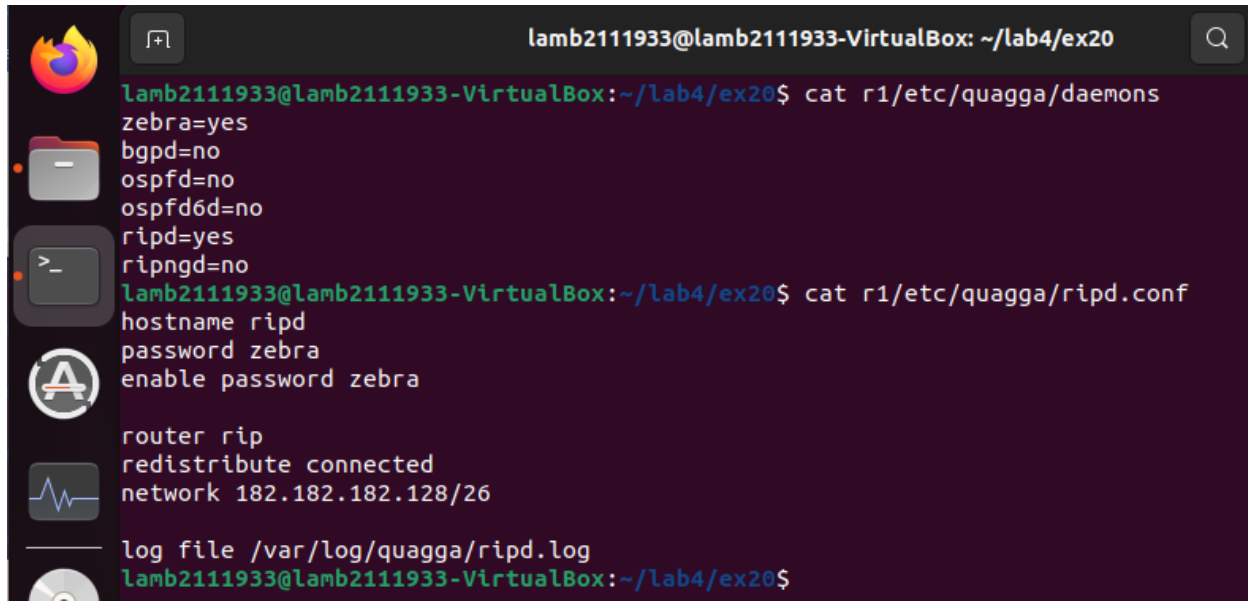
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat pc3.startup
ifconfig eth0 190.190.190.82/28 up
route add default gw 190.190.190.83

lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat server.startup
ifconfig eth0 190.190.190.81/28 up
route add default gw 190.190.190.83
/etc/init.d/apache2 start

lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$
```

Folder **etc** of **r1,r2,r3,r4** – RIPv2

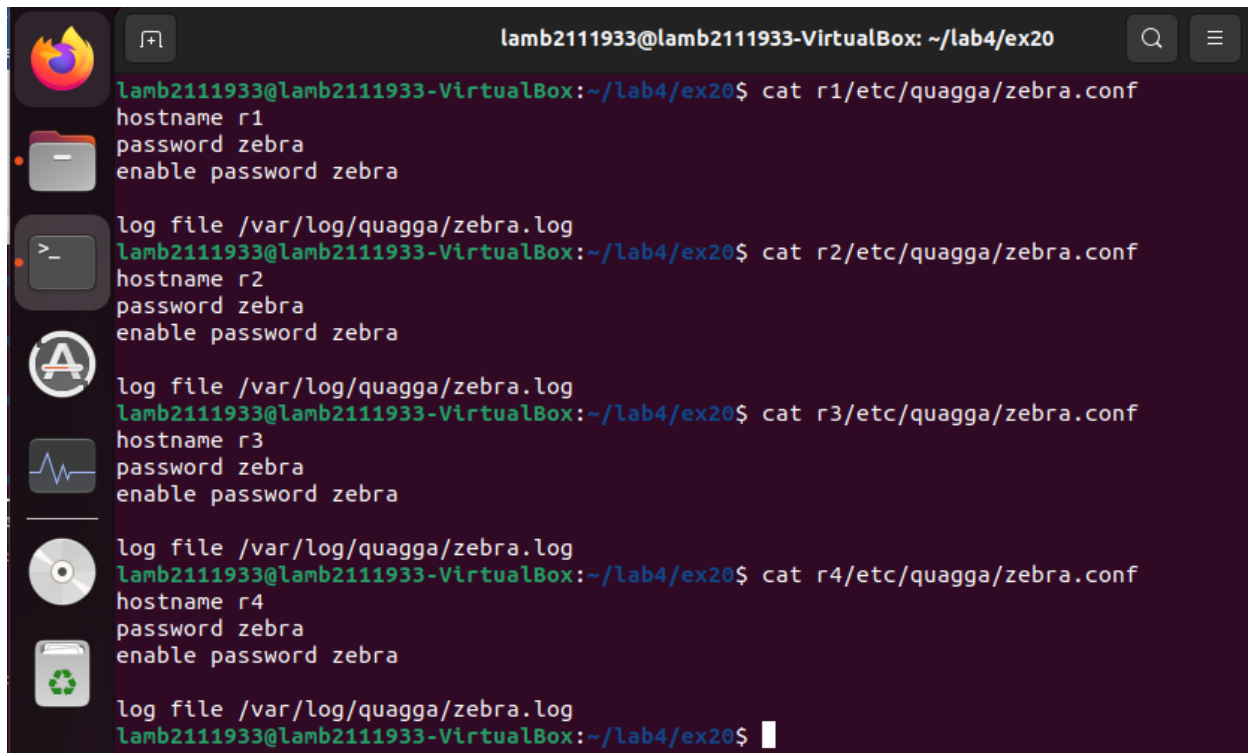
They are just the same, only a little different in **zebra.conf** (**hostname**)



```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r1/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=no
ospfd6d=no
ripd=yes
ripngd=no
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r1/etc/quagga/ripd.conf
hostname ripd
password zebra
enable password zebra

router rip
redistribute connected
network 182.182.182.128/26

log file /var/log/quagga/ripd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$
```



```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r1/etc/quagga/zebra.conf
hostname r1
password zebra
enable password zebra

log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r2/etc/quagga/zebra.conf
hostname r2
password zebra
enable password zebra

log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r3/etc/quagga/zebra.conf
hostname r3
password zebra
enable password zebra

log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r4/etc/quagga/zebra.conf
hostname r4
password zebra
enable password zebra

log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$
```

Folder **etc** of r6,r7,r8,r9 – OSPFv2

They are just the same too



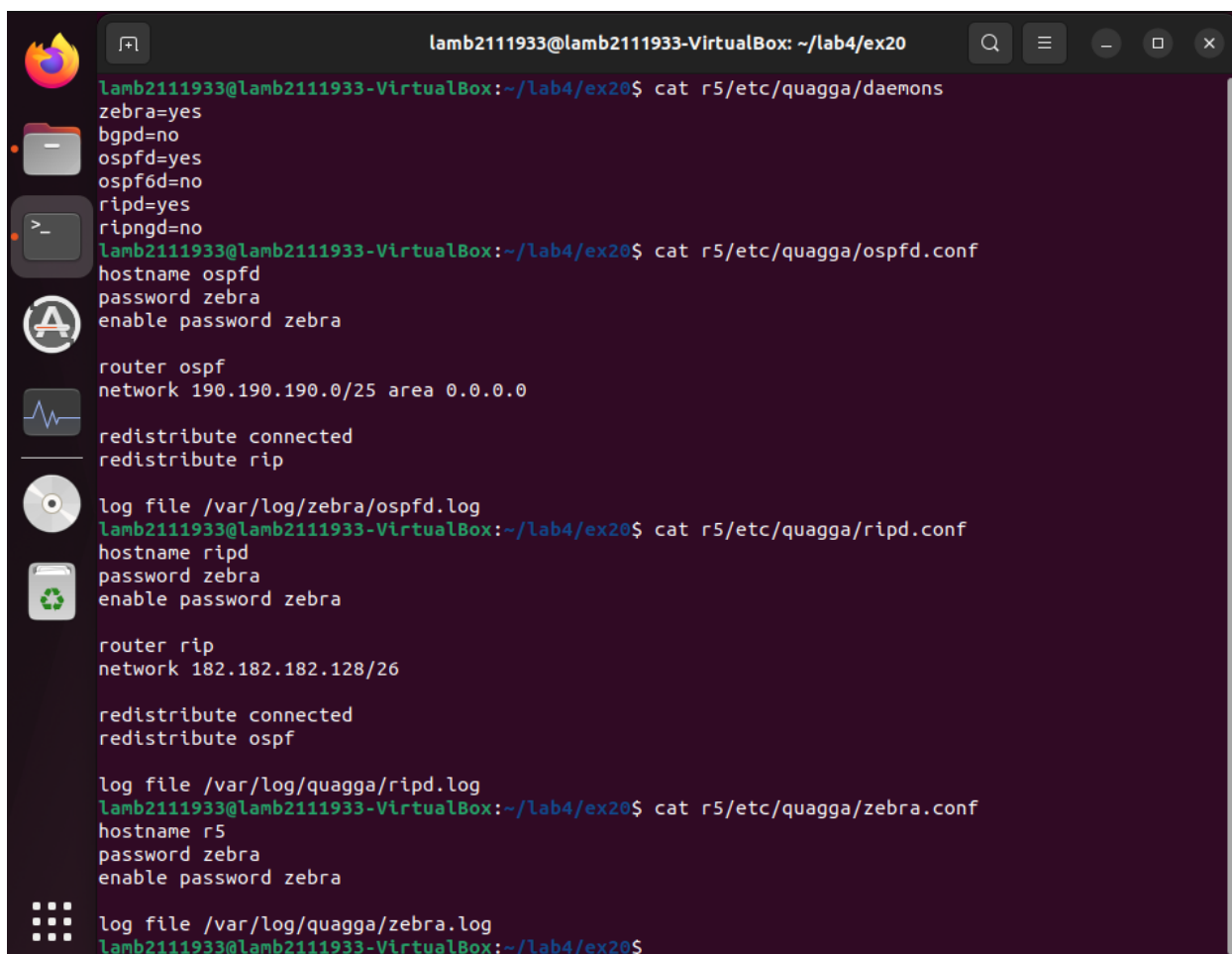
A terminal window titled 'lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20'. The terminal shows the output of two 'cat' commands. The first command, 'cat r6/etc/quagga/daemons', displays configuration for various daemons: zebra=yes, bgpd=no, ospfd=yes, ospf6d=no, ripd=no, and ripngd=no. The second command, 'cat r6/etc/quagga/ospfd.conf', displays OSPF configuration: hostname ospfd, password zebra, enable password zebra, router ospf, network 190.190.190.0/25 area 0.0.0.0, redistribute connected, and log file /var/log/zebra/ospfd.log.

```
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20$ cat r6/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=yes
ospf6d=no
ripd=no
ripngd=no
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r6/etc/quagga/ospfd.conf
hostname ospfd
password zebra
enable password zebra

router ospf
network 190.190.190.0/25 area 0.0.0.0
redistribute connected

log file /var/log/zebra/ospfd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$
```

Folder **etc** of r5 – OSPFv2 + RIPv2



A terminal window titled 'lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20'. The terminal shows the output of three 'cat' commands. The first command, 'cat r5/etc/quagga/daemons', displays configuration for daemons: zebra=yes, bgpd=no, ospfd=yes, ospf6d=no, ripd=yes, and ripngd=no. The second command, 'cat r5/etc/quagga/ospfd.conf', displays OSPF configuration: hostname ospfd, password zebra, enable password zebra, router ospf, network 190.190.190.0/25 area 0.0.0.0, redistribute connected, redistribute rip, and log file /var/log/zebra/ospfd.log. The third command, 'cat r5/etc/quagga/ripd.conf', displays RIPv2 configuration: hostname ripd, password zebra, enable password zebra, router rip, network 182.182.182.128/26, redistribute connected, redistribute ospf, and log file /var/log/quagga/ripd.log. The final command, 'cat r5/etc/quagga/zebra.conf', displays Zebra configuration: hostname r5, password zebra, enable password zebra, and log file /var/log/quagga/zebra.log.

```
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r5/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=yes
ospf6d=no
ripd=yes
ripngd=no
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r5/etc/quagga/ospfd.conf
hostname ospfd
password zebra
enable password zebra

router ospf
network 190.190.190.0/25 area 0.0.0.0
redistribute connected
redistribute rip

log file /var/log/zebra/ospfd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r5/etc/quagga/ripd.conf
hostname ripd
password zebra
enable password zebra

router rip
network 182.182.182.128/26
redistribute connected
redistribute ospf

log file /var/log/quagga/ripd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r5/etc/quagga/zebra.conf
hostname r5
password zebra
enable password zebra

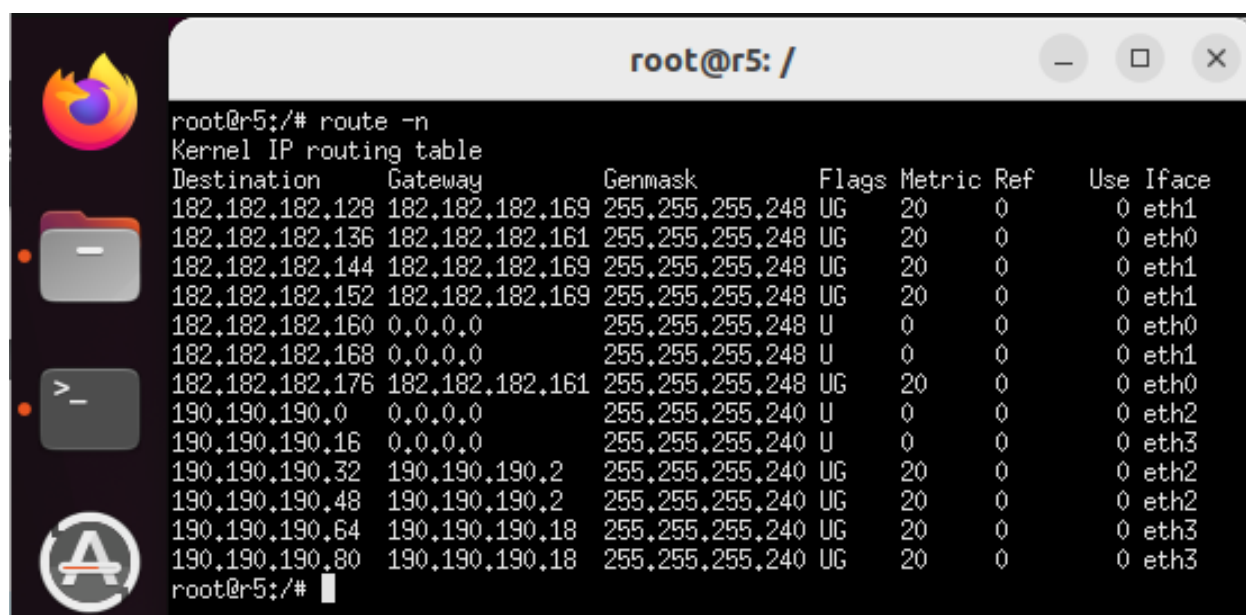
log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$
```

- Router 1, 2, 3, 4, 5 use the RIPv2 protocol.
 - The original network address is 182.182.182.128/26. What are the netmask and broadcast addresses of this original network?
 - Netmask: 255.255.255.192 (/26)
 - Broadcast address: 182.182.182.191
 - Assign the network address to each LAN on the network by subnetting the original network. What are the netmask and broadcast addresses of each subnetwork?

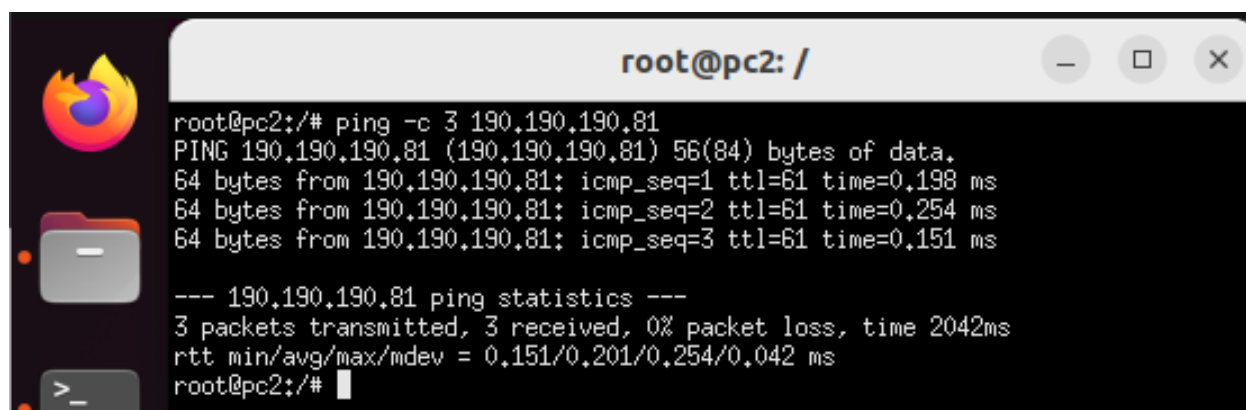
Subnet	Network Address	Broadcast Address	Netmask
A	182.182.182.128/29	182.182.182.135/29	255.255.255.248
B	182.182.182.136/29	182.182.182.143/29	255.255.255.248
C	182.182.182.144/29	182.182.182.151/29	255.255.255.248
D	182.182.182.152/29	182.182.182.159/29	255.255.255.248
E	182.182.182.160/29	182.182.182.167/29	255.255.255.248
F	182.182.182.168/29	182.182.182.175/29	255.255.255.248
G	182.182.182.176/29	182.182.182.183/29	255.255.255.248

- Router 5, 6, 7, 8, 9 use the OSPFv2 protocol.
 - The original network address is 190.190.190.0/25. What are the netmask and broadcast addresses of this original network?
 - Netmask: 255.255.255.128 (/25)
 - Broadcast address: 190.190.190.127/25
 - Assign the network address to each LAN on the network by subnetting the original network. What are the netmask and broadcast addresses of each subnetwork?

Subnet	Network Address	Broadcast Address	Netmask
J	190.190.190.0/28	190.190.190.15/28	255.255.255.240
K	190.190.190.16/28	190.190.190.31/28	255.255.255.240
L	190.190.190.32/28	190.190.190.47/28	255.255.255.240
M	190.190.190.48/28	190.190.190.63/28	255.255.255.240
N	190.190.190.64/28	190.190.190.79/28	255.255.255.240
O	190.190.190.80/28	190.190.190.95/28	255.255.255.240

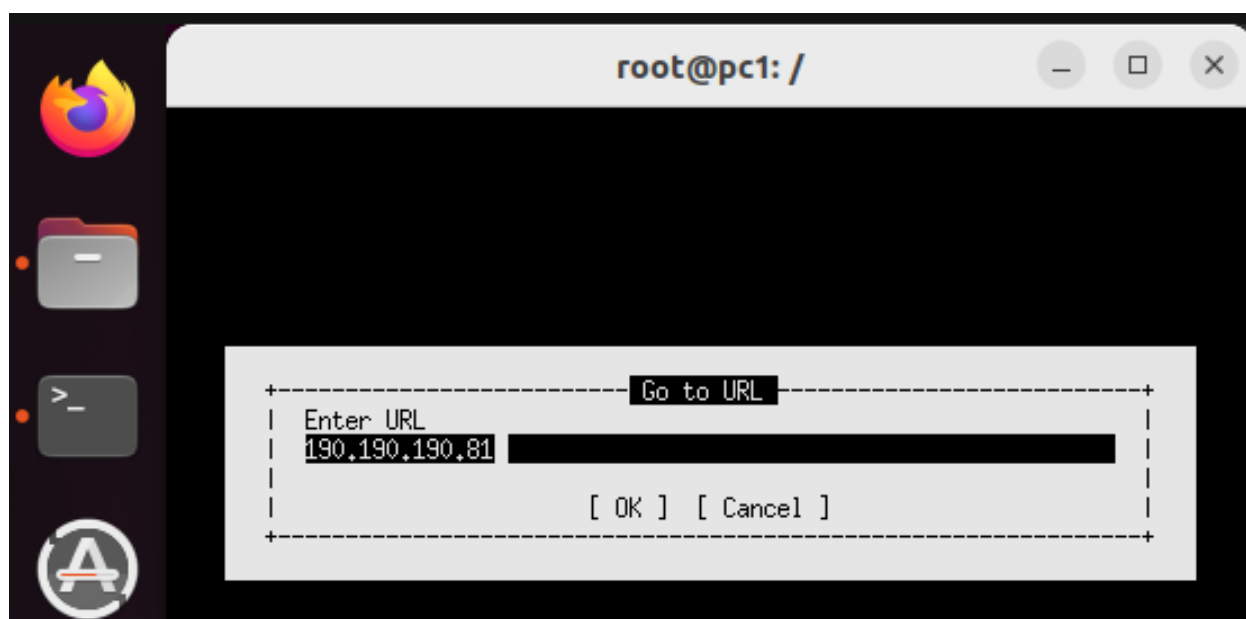


```
root@r5: /
root@r5:/# route -n
Kernel IP routing table
Destination      Gateway          Genmask         Flags Metric Ref    Use Iface
182.182.182.128  182.182.182.169 255.255.255.248 UG      20    0      0 eth1
182.182.182.136  182.182.182.161 255.255.255.248 UG      20    0      0 eth0
182.182.182.144  182.182.182.169 255.255.255.248 UG      20    0      0 eth1
182.182.182.152  182.182.182.169 255.255.255.248 UG      20    0      0 eth1
182.182.182.160  0.0.0.0          255.255.255.248 U        0    0      0 eth0
182.182.182.168  0.0.0.0          255.255.255.248 U        0    0      0 eth1
182.182.182.176  182.182.182.161 255.255.255.248 UG      20    0      0 eth0
190.190.190.0    0.0.0.0          255.255.255.240 U        0    0      0 eth2
190.190.190.16   0.0.0.0          255.255.255.240 U        0    0      0 eth3
190.190.190.32   190.190.190.2    255.255.255.240 UG      20    0      0 eth2
190.190.190.48   190.190.190.2    255.255.255.240 UG      20    0      0 eth2
190.190.190.64   190.190.190.18   255.255.255.240 UG      20    0      0 eth3
190.190.190.80   190.190.190.18   255.255.255.240 UG      20    0      0 eth3
root@r5:/#
```



```
root@pc2: /
root@pc2:/# ping -c 3 190.190.190.81
PING 190.190.190.81 (190.190.190.81) 56(84) bytes of data:
64 bytes from 190.190.190.81: icmp_seq=1 ttl=61 time=0.198 ms
64 bytes from 190.190.190.81: icmp_seq=2 ttl=61 time=0.254 ms
64 bytes from 190.190.190.81: icmp_seq=3 ttl=61 time=0.151 ms

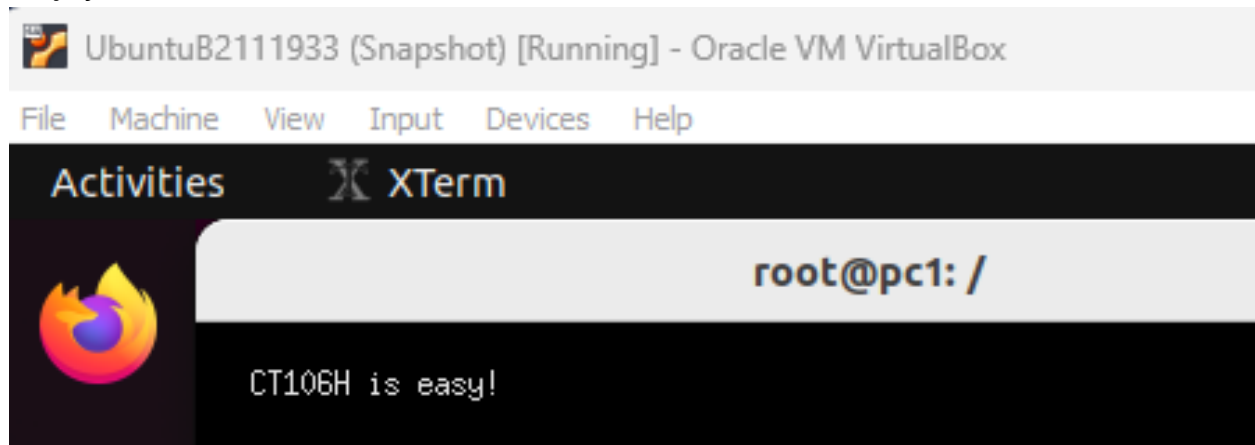
--- 190.190.190.81 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2042ms
rtt min/avg/max/mdev = 0.151/0.201/0.254/0.042 ms
root@pc2:/#
```



```
root@pc1: /

+-----+-----+-----+-----+
|                                     Go to URL                                     |
| Enter URL                                                                     |
| 190.190.190.81 [ ]                                                            |
|                                     [ OK ] [ Cancel ]                         |
+-----+-----+-----+-----+
```

Enjoy the result



(not really easy at all)